



RESEARCH DEPARTMENT



REPORT

Colour camera line-up equipment

No. 1969/27

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COLOUR CAMERA LINE-UP EQUIPMENT

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COLOUR CAMERA LINE-UP EQUIPMENT

SUMMARY

The equipment described was developed to reduce the time required to achieve correct adjustment of cameras which could not be lined up very accurately in a limited space when suitable monitoring facilities were not available. The equipment is small and relatively cheap so that it can quite easily be added to existing installations, such as colour outside broadcast vehicles.

1. INTRODUCTION

Signal levels in colour picture originating equipment must be adjusted correctly for good colour reproduction and an accurate colour match between several cameras. This is normally achieved by setting the camera to view a truly neutral object, usually a grey scale, and adjusting the controls in each of the three (or four) channels so that the channel outputs are as nearly identical as possible. These adjustments may be made by accurate measurement of each signal on an oscilloscope or by displaying the algebraic difference between the two waveforms and minimising this difference. The first method is impracticable in the case of complex waveforms, while the second method does not allow an easy compromise when an exact match cannot be achieved. Both these methods also require a high grade oscilloscope which may not be available in mobile equipment. A monochrome picture monitor is, however, usually available and since the eye is very sensitive to brightness differences between adjacent areas, it was thought that such a monitor could be used for comparing two television waveform amplitudes. Any part of a picture can be examined with a monitor, which thus has many of the facilities available with a 'line strobing' oscilloscope. The monitor, however, needs no re-adjustment to change the area of picture being examined.

This principle has been used to develop the device described below.

2. PRINCIPLE OF OPERATION

The two signals to be compared are applied to the inputs of a two-way electronic switch and the output of this

switch is displayed on a monochrome picture monitor. If the switching rate is low so that, for example, it occurs every four television fields, then any inequality between the signals will appear as a brightness flicker where the inequality exists. If the switching rate is high (for example, every four television lines), then alternate blocks of four lines will be displayed at different brightnesses and horizontal bands will be produced in the picture wherever an inequality exists.

Both rates of switching were examined. At a low switching rate it was difficult to decide which part of the picture was flickering and therefore how to correct it. With the four-line switching rate small areas could be examined for the presence of a pattern and it was easy to decide the adjustments required to minimise it. For sensitive error indication, the switching rate must be arranged so that the horizontal pattern moves slowly through the picture; this can easily be achieved if a divide-by-four counter is fed with line-drive pulses and the counter output used to operate the electronic switch, the pattern then moves from the bottom of the picture to the top in 12.5 sec., that is, at the rate of one line per field.

Differential errors of 0.5% in magnitude between two signals can easily be seen, particularly if the picture-monitor brightness is reduced when bright areas of the picture are examined.

3. THE PROTOTYPE EQUIPMENT

This particular equipment was designed for use with a three-tube colour camera but the principle can be applied where matching of any two or more waveforms is required. Fig. 1 shows a block diagram of the equipment.

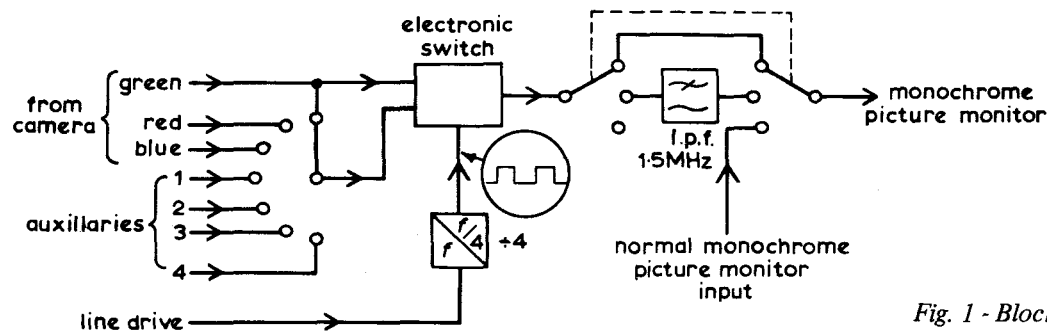


Fig. 1 - Block diagram of the equipment

One side of the electronic switch is always fed with the green signal from the camera and this is used as the reference for the red and blue signals. The other side of the switch can be fed with the red or blue signals as required, and with the green signal so that a check is always available of the accuracy of balance of the switch itself. Several auxiliary inputs are provided, these are normally fed with the green signals of associated cameras so that they may easily be adjusted to match that of one 'master' camera. The auxiliary inputs can also be used to provide a reference such as white level or a gamma-corrected sawtooth for the initial setting of the green channel. An optional low-pass filter of about 1.5 MHz bandwidth is provided in the switched output so that the effects of random noise may be minimised.

4. METHOD OF USE

In the case of a three-tube camera the green channel would be set up in the normal way using an oscilloscope. Adjustment of white clipping level may be achieved by using a white-level signal as an auxiliary input; the absolute calibration of the oscilloscope is not critical. All adjustments of such items as black-level, gamma correction, automatic black-level compensation, gain etc. can then be carried out by matching the red and blue channels in turn with the previously adjusted green channel.

5. CONCLUSIONS

This equipment has been in use on a number of three-tube cameras for some time and, with a truly neutral grey-scale chart, has saved time and increased the accuracy of line-up of the signal processing circuits.